The publication United States Patent No. 5,701,404 discloses a method for trimming non-uniform rational B-spline surfaces according to curves projected onto them. However, this method suffers from the disadvantage that the basic overall shape of the original outline is not always retained.

IN THE CLAIMS:

Please amend the claims and add new Claims 58 to 60 to read as follows. All claims currently pending in the application, including those not amended, are reproduced below. A marked-up copy of the amended claims, showing the changes made thereto, is attached.

1. (Twice Amended) A method for generating a graphical object comprising a plurality of closed loops by transforming a set of one or more closed first curves defining a boundary of a surface to the plurality of closed loops, wherein the set of one or more closed first curves contains no self-crossover points, the method comprising the steps of:

a providing step of providing a set of continuous second curves lying on the surface, wherein each of the continuous second curves intersects and crosses over one or more of the closed first curves and the set of continuous second curves contains no self-crossover points;

a first determining step of determining a set of intersection points, wherein the intersection points are those points where the one or more closed first curves intersect the continuous second curves and which lie on the boundary of the surface;

a second determining step of determining a set of crossover points from the determined set of intersection points;

an assembling step of assembling the plurality of closed loops from curve intervals, delimited by adjacent determined crossover points, from the set of one or more closed first curves and the set of continuous second curves in accordance with a predetermined rule, whereby the plurality of closed loops abuts a substantial portion of the boundary of the surface; and

a filling step of filling the plurality of closed loops with a fill to produce the graphical object.

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2. (Twice Amended) A method as claimed in claim 1, wherein said assembling step comprises the substeps of:

an ordering substep of ordering the set of crossover points in accordance with a predetermined order;

a first marking substep of marking one of the crossover points that is highest in the predetermined order and that has not been previously marked;

a determining substep of determining if a last marked crossover point is a first point in a closed loop, and if so performing:

a first selecting substep of selecting a curve interval starting at the first point and terminating at an unmarked crossover point; and

a second marking substep of marking the terminating crossover point of the selected curve interval; or if not performing:

a second selecting substep of selecting a curve interval starting at the previous terminating crossover point and terminating at an unmarked crossover point; and

a third marking substep of marking the current terminating crossover point of the selected curve interval;

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a first repetition substep of repetitively performing the determining substep until the closed loop is formed; and

a second repetition substep of repetitively performing the first marking, determining and the first repetition substeps until all possible closed loops have been formed.

3. (Unchanged From Prior Version) A method as claimed in claim 2, wherein when it is determined in said determining substep that the last marked crossover point is a first point in a closed loop, the curve interval is selected from the set of one or more closed first curves, wherein the selected curve interval starts at the first point, continues in a first direction, and terminates at a next adjacent unmarked crossover point.

4. (Twice Amended) A method as claimed in claim 3, wherein when it is determined in said determining substep that the last marked crossover point is not a first point in a closed loop, the curve interval is selected from the set of one or more closed first

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curves or the set of continuous second curves, wherein the selected curve interval is the first curve interval encountered around the last marked crossover point in a second direction starting from the previously selected curve interval and which continues in a third direction and terminates at a next adjacent unmarked crossover point.

5. (Twice Amended) A method as claimed in claim 4, wherein said substep of ordering the set of crossover points comprises ordering the crossover points according to their position along the set of one or more closed first curves in a fourth direction.

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6. (Twice Amended) A method as claimed in claim 5, wherein the first direction and the fourth direction are in a forward direction, the third direction is either in a positive or a negative direction, and the second direction is in the same direction as a backward direction.

7. (Twice Amended) A method as claimed in claim 5, wherein the first direction and the fourth direction are in a backward direction, the third direction is either in a positive or a negative direction, and the second direction is in the same direction as a forward direction.

8. (Unchanged From Prior Version) A method as claimed in claim 1, wherein the surface is a 2-dimensional surface.

9. (Unchanged From Prior Version) A method as claimed in claim 1, wherein the surface is a 3-dimensional surface.

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10. (Twice Amended) A method as claimed in claim 1, wherein said filling step comprises filling the plurality of closed loops with a predetermined color.

11. (Unchanged From Prior Version) A method as claimed in claim 1, wherein said step of providing a set of continuous second curves, comprises the substep of generating the set of continuous second curves.

12. (Unchanged From Prior Version) A method as claimed in claim 1, wherein said step of providing a set of continuous second curves, comprises the substep of accessing the set of continuous second curves from storage.

13. (Unchanged From Prior Version) A method as claimed in claim 1, wherein said step of providing a set of continuous second curves, comprises the substep of selecting one of a plurality of sets of continuous second curves in response to user input.

14. (Unchanged From Prior Version) A method as claimed in claim 11, wherein said generating substep comprises inputting parameters.

15. (Unchanged From Prior Version) A method as claimed in claim 14, wherein the input parameters comprise one or more of the following: base shapes of the continuous second curves, a period of the continuous second curves, and an amplitude of the continuous second curves.

16. (Unchanged From Prior Version) A method as claimed in claim 15, wherein the amplitude of the continuous second curves varies throughout.

17. (Unchanged From Prior Version) A method as claimed in claim 1, wherein the set of one or more closed first curves constitutes a character glyph of a font.

18. (Twice Amended) An apparatus for generating a graphical object comprising a plurality of closed loops by transforming a set of one or more closed first curves defining a boundary of a surface to the plurality of closed loops, wherein the set of one or more closed first curves contains no self-crossover points, the apparatus comprising:

providing means for providing a set of continuous second curves lying on the surface, wherein each of the continuous second curves intersects and crosses over one or more of the closed first curves and the set of continuous second curves contains no self-crossover points;

first determining means for determining a set of intersection points, wherein the intersection points are those points where the one or more closed first curves intersect the continuous second curves and which lie on the boundary of the surface;

second determining means for determining a set of crossover points from the set of intersection points;

assembling means for assembling the plurality of closed loops from curve intervals, delimited by adjacent determined crossover points, from the set of one or more closed first curves and the set of continuous second curves in accordance with a predetermined rule, whereby the plurality of closed loops abuts a substantial portion of the boundary of the surface; and

filling means for filling the plurality of closed loops with a fill to produce the graphical object.

19. (Twice Amended) An apparatus as claimed in claim 18, wherein said assembling means comprises:

ordering means for ordering the set of crossover points in accordance with a predetermined order;

first marking means for marking one of the crossover points that is highest in the predetermined order and that has not been previously marked;

first selecting means for selecting a curve interval starting at a first point and terminating at an unmarked crossover point;

second marking means for marking the terminating crossover point of the selected curve interval;

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second selecting means for selecting a curve interval starting at the previous terminating crossover point and terminating at an unmarked crossover point;

third marking means for marking the current terminating crossover point of the selected curve interval;

third determining means for determining if a last marked crossover point is the first point in a closed loop, and if so performing the operations of said first selecting means and said second marking means, or if not, performing the operations of said second selecting means and said third marking means;

means for repetitively performing the operations of said third determining means until the closed loop is formed; and

means for repetitively performing the operations of said first marking means and said third determining means until all possible closed loops have been formed.

20. (Twice Amended) An apparatus as claimed in claim 19, wherein said first selecting means selects the curve interval from the set of one or more closed first curves, wherein the selected curve interval starts at the first point, continues in a first direction, and terminates at a next adjacent unmarked crossover point.

21. (Twice Amended) An apparatus as claimed in claim 20, wherein said second selecting means selects the curve interval from the set of one or more closed first curves or the set of continuous second curves, wherein the selected curve interval is the first curve interval encountered around the last marked crossover point in a second direction starting from the previously selected curve interval and which continues in a third direction and terminates at a next adjacent unmarked crossover point.

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22. (Twice Amended) An apparatus as claimed in claim 21, wherein said ordering means orders the set of crossover points according to their position along the set of one or more closed first curves in a fourth direction.

23. (Twice Amended) An apparatus as claimed in claim 22, wherein the first direction and the fourth direction are in a forward direction, the third direction is either in a positive or a negative direction, and the second direction is in the same direction as a backward direction.

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24. (Twice Amended) An apparatus as claimed in claim 22, wherein the first direction and the fourth direction are in a backward direction, the third direction is either in a positive or a negative direction, and the second direction is in the same direction as a forward direction.

25. (Unchanged From Prior Version) An apparatus as claimed in claim 18, wherein the surface is a 2-dimensional surface.

26. (Unchanged From Prior Version) An apparatus as claimed in claim 18, wherein the surface is a 3-dimensional surface.

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27. (Twice Amended) An apparatus as claimed in claim 18, wherein said filling means comprises means for filling the plurality of closed loops with a predetermined color.

28. (Unchanged From Prior Version) An apparatus as claimed in claim 18, wherein said providing means comprises means for generating the set of continuous second curves.

29. (Unchanged From Prior Version) An apparatus as claimed in claim 18, wherein said providing means comprises means for accessing the set of continuous second curves from storage.

30. (Unchanged From Prior Version) An apparatus as claimed in claim 18, wherein said providing means comprises means for selecting one of a plurality of sets of continuous second curves in response to user input.

31. (Unchanged From Prior Version) An apparatus as claimed in claim 28, wherein said generating means comprises means for inputting parameters.

32. (Unchanged From Prior Version) An apparatus as claimed in claim 31, wherein the input parameters comprise one or more of the following: base shapes of the continuous second curves, a period of the continuous second curves, and an amplitude of the continuous second curves.

33. (Unchanged From Prior Version) An apparatus as claimed in claim 32, wherein the amplitude of the continuous second curves varies throughout.

34. (Unchanged From Prior Version) An apparatus as claimed in claim 18, wherein the set of one or more closed first curves constitutes a character glyph of a font.

35. (Twice Amended) A computer program product comprising a computer readable medium including a computer program for generating a graphical object comprising a plurality of closed loops by transforming a set of one or more closed first curves defining a boundary of a surface to the plurality of closed loops, wherein the set of

one or more closed first curves contains no self-crossover points, the computer program product comprising:

providing means for providing a set of continuous second curves lying on the surface, wherein each of the continuous second curves intersects and crosses over one or more of the closed first curves and the set of continuous second curves contains no self-crossover points;

first determining means for determining a set of intersection points, wherein the intersection points are those points where the one or more closed first curves intersect the continuous second curves and which lie on the boundary of the surface;

second determining means for determining a set of crossover points from the set of intersection points;

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assembling means for assembling the plurality of closed loops from curve intervals, delimited by adjacent determined crossover points, from the set of one or more closed first curves and the set of continuous second curves in accordance with a predetermined rule, whereby the plurality of closed loops abuts a substantial portion of the boundary of the surface; and

filling means for filling the plurality of closed loops with a fill to produce the graphical object.

36. (Twice Amended) A computer program product as claimed in claim 35, wherein said assembling means comprises:

ordering means for ordering the set of crossover points in accordance with a predetermined order;

first marking means for marking one of the crossover points that is highest in the predetermined order and that has not been previously marked;

first selecting means for selecting a curve interval starting at a first point and terminating at an unmarked crossover point;

second marking means for marking the terminating crossover point of the selected curve interval;

second selecting means for selecting a curve interval starting at the previous terminating crossover point and terminating at an unmarked crossover point;

third marking means for marking the current terminating crossover point;

third determining means for determining if the last marked crossover point is the first point in a closed loop, and if so performing the operations of said first selecting means and said second marking means, or if not, performing the operations of said second selecting means and said third marking means;

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means for repetitively performing the operations of said third determining means until the closed loop is formed; and

means for repetitively performing the operations of said first marking means and said third determining means until all possible closed loops have been formed.

37. (Twice Amended) A computer program product as claimed in claim 36, wherein said first selecting means selects the curve interval from the set of one or more closed first curves, wherein the selected curve interval starts at the first point, continues in a first direction, and terminates at a next adjacent unmarked crossover point.

38. (Twice Amended) A computer program product as claimed in claim 37, wherein said second selecting means selects the curve interval from the set of one or more closed first curves or the set of continuous second curves, wherein the selected curve interval is the first curve interval encountered around the last marked crossover point in a second direction starting from the previously selected curve interval and which continues in a third direction and terminates at a next adjacent unmarked crossover point.

39. (Twice Amended) A computer program product as claimed in claim 38, wherein said ordering means orders the set of crossover points according to their position along the set of one or more closed first curves in a fourth direction.

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40. (Twice Amended) A computer program product as claimed in claim 39, wherein the first direction and the fourth direction are in a forward direction, the third direction is either in a positive or a negative direction, and the second direction is in the same direction as a backward direction.

41. (Twice Amended) A computer program product as claimed in claim 39, wherein the first direction and the fourth direction are in a backward direction, the third direction is either in a positive or a negative direction, and the second direction is in the same direction as a forward direction.

42. (Unchanged From Prior Version) A computer program product as claimed in claim 35, wherein the surface is a 2-dimensional surface.

43. (Unchanged From Prior Version) A computer program product as claimed in claim 35, wherein the surface is a 3-dimensional surface.

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44. (Twice Amended) A computer program product as claimed in claim 35, wherein said filling means comprises means for filling the plurality of closed loops with a predetermined color.

45. (Unchanged From Prior Version) A computer program product as claimed in claim 35, wherein said providing means comprises means for generating the set of continuous second curves.

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46. (Twice Amended) A computer program product as claimed in claim 35, wherein said providing means comprises means for retrieving the set of continuous second curves from storage.

47. (Unchanged From Prior Version) A computer program product as claimed in claim 35, wherein said providing means comprises means for selecting one of a plurality of sets of continuous second curves in response to user input.

48. (Unchanged From Prior Version) A computer program product as claimed in claim 45, wherein said generating means comprises means for inputting parameters.

49. (Unchanged From Prior Version) A computer program product as claimed in claim 48, wherein said input parameters comprise one or more of the following: base shapes of the continuous second curves, a period of the continuous second curves, and an amplitude of the continuous second curves.

50. (Unchanged From Prior Version) A computer program product as claimed in claim 49, wherein the amplitude of the continuous second curves varies throughout.

51. (Unchanged From Prior Version) A computer program product as claimed in claim 35, wherein the set of one or more closed first curves constitutes a character glyph of a font.

52. (Twice Amended) A method of modifying a typeface, font, or character, wherein the typeface, font, or character comprises a set of one or more closed first curves defining a boundary of a surface of the typeface, font, or character, wherein the set of one or more closed first curves contains no self-crossover points, the method comprises the steps of:

a providing step of providing a set of continuous second curves lying on the surface, wherein each of the continuous second curves intersects and crosses over one or more of the closed first curves and the set of continuous second curves contains no self-crossover points;

a first determining of determining a set of intersection points, wherein the intersection points are those points where the one or more closed first curves intersect the continuous second curves and which lie on the boundary of the surface;

a second determining step of determining a set of crossover points from the set of intersection points;

an assembling step of assembling a plurality of closed loops from curve intervals, delimited by adjacent determined crossover points, from the set of one or more closed first curves and the set of continuous second curves in accordance with a predetermined rule, whereby the plurality of closed loops abuts a substantial portion of the boundary of the surface; and

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a filling step of filling the plurality of closed loops with a fill to form the modified typeface, font, or character.

53. (Twice Amended) An apparatus for modifying a typeface, font, or character, wherein the typeface, font, or character comprises a set of one or more closed first curves defining a boundary of a surface of the typeface, font, or character, wherein the set of one or more closed first curves contains no self-crossover points, the apparatus comprising:

means for providing a set of continuous second curves lying on the surface, wherein each of the continuous second curves intersects and crosses over one or more of the closed first curves and the set of continuous second curves contains no self-crossover points;

means for determining a set of intersection points, wherein the intersection points are those points where the one or more closed first curves intersect the continuous second curves and which lie on the boundary of the surface;

means for determining a set of crossover points from the set of intersection points;

assembling means for assembling a plurality of closed loops from curve intervals, delimited by adjacent determined crossover points, from the set of one or more closed first curves and the set of continuous second curves in accordance with a predetermined rule, whereby the plurality of closed loops abuts a substantial portion of the boundary of the surface; and

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filling means for filling the plurality of closed loops with a fill to form the modified typeface, font, or character.

54. (Twice Amended) A computer program product comprising a computer readable medium including a computer program for modifying a typeface, font, or character, wherein the typeface, font, or character comprises a set of one or more closed first curves defining a boundary of a surface of the typeface, font, or character, wherein the set of one or more closed first curves contains no self-crossover points, the computer program product comprising:

means for providing a set of continuous second curves lying on the surface, wherein each of the continuous second curves intersects and crosses over one or more of the closed first curves and the set of continuous second curves contains no self-crossover points;

means for determining a set of intersection points, wherein the intersection points are those points where the one or more closed first curves intersect the continuous second curves and which lie on the boundary of the surface;

means for determining a set of crossover points from the set of intersection points;

assembling means for assembling a plurality of closed loops from curve intervals, delimited by adjacent determined crossover points, from the set of one or more closed first curves and the set of continuous second curves in accordance with a predetermined rule, whereby the plurality of closed loops abuts a substantial portion of the boundary of the surface; and

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filling means for filling the plurality of closed loops with a fill to form the modified typeface, font, or character.

55. (Twice Amended) A method of modifying a typeface, font, or character, wherein the typeface, font, or character comprises a set of one or more closed first curves defining a boundary of a surface of the typeface, font, or character, wherein the set of one or more closed first curves contains no self-crossover points, the method comprises the steps of:

providing a set of continuous second curves lying on the surface, wherein each of the continuous second curves intersects and crosses over one or more of the closed first curves and the set of continuous second curves contains no self-crossover points;

determining a set of intersection points, wherein the intersection points are those points where the one or more closed first curves intersect the continuous second curves and which lie on the boundary of the surface;

determining a set of crossover points from the set of intersection points;

selecting unmarked adjacent crossover points from the set of determined crossover points to a form a closed loop;

marking the selected adjacent crossover points;

repetitively performing the selecting and marking steps until a set of closed loops have been formed, wherein the set of closed loops abuts a substantial portion of the boundary of the surface; and

filling the set of closed loops with a fill to form the modified typeface, font, or character.

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56. (Twice Amended) Apparatus for modifying a typeface, font, or character, wherein the typeface, font, or character comprises a set of one or more closed first curves defining a boundary of a surface of the typeface, font, or character, wherein the set of one or more closed first curves contains no self-crossover points, the apparatus comprising:

means for providing a set of continuous second curves lying on the surface, wherein each of the continuous second curves intersects and crosses over one or more of the closed first curves and the set of continuous second curves contains no self-crossover points;

means for determining a set of intersection points, wherein the intersection points are those points where the one or more closed first curves intersect the continuous second curves and which lie on the boundary of the surface;

means for determining a set of crossover points from the set of intersection points;

means for selecting unmarked adjacent crossover points from the set of determined crossover points to a form a closed loop;

means for marking the selected adjacent crossover points; and

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means for repetitively performing the operations of said selection means and said marking means until a set of closed loops have been formed, wherein the set of closed loops abuts a substantial portion of the boundary of the surface; and

means for filling the set of closed loops with a fill to form the modified typeface, font, or character.

57. (Twice Amended) A computer program product comprising a computer readable medium including a computer program for modifying a typeface, font, or character, wherein the typeface, font, or character comprises a set of one or more closed first curves defining a boundary of a surface of the typeface, font, or character, wherein the

set of one or more closed first curves contains no self-crossover points, the computer program comprising:

means for providing a set of continuous second curves lying on the surface, wherein each of the continuous second curves intersects and crosses over one or more of the closed first curves and the set of continuous second curves contains no self-crossover points;

means for determining a set of intersection points, wherein the intersection points are those points where the one or more closed first curves intersect the continuous second curves and which lie on the boundary of the surface;

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means for determining a set of crossover points from the set of intersection points;

means for selecting unmarked adjacent crossover points from the set of determined crossover points to form a closed loop;

means for marking the selected adjacent crossover points;

means for repetitively performing the operations of said selection means and said marking means until a set of closed loops have been formed, wherein the set of closed loops abuts a substantial portion of the boundary of the surface; and

means for filling the set of closed loops with a fill to form the modified typeface, font, or character.

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58. (New) A method for generating a graphical object comprising a plurality of closed loops by transforming a set of closed first curves defined on a surface, the method comprising the steps of:

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providing a pattern comprising a set of continuous second curves that intersect the set of closed first curves upon the surface;

determining crossover points of the intersections of the set of closed first curves and the set of continuous second curves;

generating closed loops in accordance with the determined crossover points, wherein the closed loops abut a substantial portion of the boundary of the surface; and

filling the closed loops with a predetermined color to produce the graphical object.

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59. (New) An apparatus for generating a graphical object comprising a plurality of closed loops by transforming a set of closed first curves defined on a surface, the apparatus comprising:

means for providing a pattern comprising a set of continuous second curves that intersect the set of closed first curves upon the surface;

means for determining crossover points of the intersections of the set of closed first curves and the set of continuous second curves;

means for generating closed loops in accordance with the crossover points, wherein the closed loops abut a substantial portion of the boundary of the surface; and

means for filling the closed loops with a predetermined color to produce the graphical object.

60. (New) A computer program product comprising a computer readable medium including a computer program for generating a graphical object comprising a

plurality of closed loops by transforming a set of closed first curves defined on a surface, the computer program product comprising:

means for providing a pattern comprising a set of continuous second curves that intersect the set of closed first curves upon the surface;

means for determining crossover points of the intersections of the set of closed first curves and the set of continuous second curves;

means for generating closed loops in accordance with the crossover points, wherein the closed loops abut a substantial portion of the boundary of the surface; and

means for filling the closed loops with a predetermined color to produce the graphical object.

REMARKS

This application has been carefully reviewed in light of the Office Action dated June 18, 2002 (Paper No. 12), and the Advisory Action dated October 7, 2002 (Paper No. 15). Claims 1 to 60 are in the application, with Claims 58 to 60 having been added herein. Claims 1, 18, 35 and 52 to 60 are the independent claims.

Procedurally, this Second Amendment After Final Rejection re-presents the claim amendments made in the Amendment After Final Rejection dated September 18, 2002, in view of the Advisory Action that indicated that the Amendment After Final Rejection would not be entered. In addition, further claim amendments have been made and new Claims 59 and 60 have been added in this Second Amendment After Final Rejection.